



Materials Engineering Branch

TIP*



No. 124 Locking of Fasteners

Author(s): Michael Barthelmy

Contact: (301) 286-6882

It is imperative that fasteners not only be tightened to the proper axial preload but that the preload also be maintained throughout the operating life of the structure. Numerous methods are available to the spacecraft designer for ensuring that fasteners do not loosen and fail.

POSITIVE RETENTION DEVICES--Cotter pins lock wire, Lock Cable, tab retention devices--Offer positive locking of fasteners but may allow some degree of preload loss. They require specialized hardware and features that may entail longer lead times and an increase in assembly time.

LOCKING POLYMERS--Uralane 5753LV A/B or Solithane 113/300 can be applied to lock threads and also allow for future disassembly. Note that the shear strength of these materials is low and their vibration resistance has not been tested per MIL-STD-1312. Disadvantages: messy and time consuming to apply during assembly, difficult to clean on disassembly and results in particulate generation. Epoxy resins have higher shear strengths but disassembly may be difficult to impossible.

PREVAILING TORQUE LOCKNUTS--SOFT INSERT--Kel-F and Vespel are the preferred insert materials although nylon or Zytel are widely available and may be acceptable depending on the application. These materials may be pressed into holes or slots in the bolts. Nylon/Zytel is also available as a patch. On a nut, the polymer is used as a collar or in a hole that is drilled through the body. All of these features provide an interference fit between mating thread elements. Advantages: convenient, good retaining torque, and high reusability. Disadvantages: galling has resulted from flash associated with machining the slot or hole; the leading edge of helical thread inserts cuts the soft polymer in bolts and destroys the locking effectiveness.

PREVAILING TORQUE LOCKNUTS--ALL METAL—deflected beam, out-of-round collar, deflected thread types and Spiralock.

- Deflected beam, out-of-round collar and deflected thread types: The most commonly used locknuts. Deflected beam locknuts tend to have the highest reusability, galling resistance, weight and cost. The chief disadvantage is that numerous assembly cycles of the out-of-round collar and deflected thread types scar bolt threads and generate particulates.
- Spiralock: Free running lock nuts that deform under torque to produce a locking action. Minimal assembly time and damage to threads.

LOCKING HELICAL INSERTS--helical inserts lock by means of one crimped wire turn. Advantages: convenient, good locking torque on initial installations. Disadvantages: Limited reusability and wire-like slivers result from repeated assembly/disassembly cycles.